HAIR REMOVAL DEVICE WITH DISC AND VIBRATION ASSEMBLIES

This is a continuation-in-part of application serial no. 09/246,454, filed February 9, 1999 and will issue on September 26, 2000 as U.S. Patent No. 6,123,713, which is itself a continuation-in-part of application serial no. 09/112,971, filed July 9 ,1998 and issued November 2, 1999 as U.S. Patent No. 5,976,157. We incorporate both patents by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates generally to a depilatory device for removal of unwanted hair, and more specifically, to a device for removing unwanted hair by trapping and uprooting the hair while at the same time massaging the hair-removal area to reduce discomfort associated with hair removal.

BACKGROUND OF THE INVENTION

There exists a need for removal of unwanted hair in order to maintain a desirable physical appearance. There are many devices known in the art that are useful for removing unwanted hair such as razors, tweezers and other depilatory devices. Although razors provide quick and easy hair removal, hair remains visible at the surface of the skin and quickly regrows. Therefore one must shave frequently in order to maintain smooth skin and a desired appearance.

On the other hand, tweezers provide longer-lasting hair removal than razors since, instead of merely cutting hair, tweezers remove the hair at its root. However, removing hair with tweezers is a tedious process since traditional tweezers can only remove one hair at a time and precise handling of the tweezers is required in order to position and grasp the hair between the two, usually small, opposing surfaces. Furthermore, care must be taken so that the hair is not inadvertently broken above the root leaving stubbles.

Other depilatory devices are known in the art such as one described in U.S. Patent No. 5,281,233 to Dolev ("Dolev patent"). The Dolev hair removal device generally comprises a housing and a hair-plucking assembly rotatably mounted to the housing. The hair plucking assembly includes at least one disc assembly comprising (i) a pair of complementary discs, each of the discs having at least three radially extending arms

terminating in flattened peripheral portions, which, when pressed against corresponding flattened peripheral portion of the arms of the other disc, form a trap for the hair; and (ii) a hub for accommodating and rotating the pair of discs so that the flattened peripheral portions of the discs are alternately brought together to form a trap to grasp the hair to be removed, and forced apart to eject the removed hair. The Dolev hair device, however, merely includes one row of disc assemblies, which limits the number of hair it can remove at one time. Moreover, it lacks any mechanism for making the hair-removal process more comfortable for the user.

There is a need, therefore, for a depilatory device that is as easy and inexpensive to assemble and maintain as prior art devices but, at the same time, can easily uproot a greater number of hairs over a larger hair-removal area than is currently possible. In addition, there is also an ongoing need for depilatory devices to reduce discomfort associated with hair removal.

SUMMARY OF THE INVENTION

According to the present invention, the foregoing and other objects and advantages are attained by a hair removal device comprising a housing and a hair-plucking assembly. In preferred embodiments, the hair-removal assembly includes at least two groups of disc assemblies mounted within the housing. The disc assemblies may be arranged in at least two rows, which may be adjacent and/or parallel to one another. Disc assemblies arranged in a row may be rotationally fixed with respect to one another and may rotate together at a constant speed.

The disc assemblies may also be identical to one another. Each disc assembly may include an internal disc assembly and a pair of outer discs. Each internal disc may, in turn, comprise an insert disc having at least one arm and may be mounted on a disc carrier. Each outer disc may also have at least one arm and may be mounted on the internal disc assembly. The arm(s) of each outer disc may be pressed against the arm(s) of the internal disc to form traps for hair.

The disc carrier may further comprise at least one U-shaped member for engaging at least one arm of each of the pair of outer discs so as to impart rotational motion to the pair of outer discs upon rotation of the internal structure about an axis of the internal structure. The disc carrier may further comprise at least a pair of pinchers that extends

axially from the U-shaped member(s) beyond the plane of the arm of each of the pair of outer discs for imparting a clamping force on at least one adjacent disc carrier. The disc carrier may further comprise engagement means for engaging at least one adjacent disc carrier so that rotational movement of one disc carrier imparts rotational motion to at least one adjacent disc carrier. The engagement means may comprise engagement protrusions and engagement recessions for engaging corresponding protrusions and recessions of at least one adjacent disc carrier. Finally, disc assemblies may be rotatably mounted on two shafts. The shafts may further be curved so that the disc assemblies are mounted in an inclined angle.

In accordance with another preferred embodiment of the invention, the hair removal device may comprise a housing, a hair-plucking assembly, and a vibration assembly mounted within the housing. The vibration assembly may comprise a vibration element to massage the hair removal area. This vibration element may be rotatably mounted on eccentric cylinders and may vibrate at a constant speed.

The housing may comprise brackets for mounting the hair-plucking assembly and vibration assembly to the housing. The vibration element may be located adjacent to the hair-plucking assembly and may act to move towards and away from the hair-plucking assembly. The vibration element may span at least the width of the hair-plucking assembly.

As discussed above, the hair-plucking assembly may comprise disc assemblies which are arranged in two rows, wherein the vibration element may be located between the rows of disc assemblies. The hair-plucking assembly and the vibration assembly may be powered by a driving assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is made to the following Detailed Description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevational view of a hair remover according to the invention;
FIG. 2 is a top plan view of the hair remover of Fig. 1;
FIG. 3 is a side elevational view of the hair remover of Fig. 1;

FIG. 4 is a front partial section view of the hair remover taken along line A-A of FIG. 3, featuring a number of disc assemblies;

FIG. 5 is a side partial section view taken along line 2-2 of the hair remover of Fig. 4;

FIG. 6 is a front partial section view of the hair remover taken along line B-B of FIG. 5, featuring a number of disc assemblies;

FIG. 7 is an exploded view of the outer discs and the internal disc assembly of the invention;

FIG. 8 is a plan view of the disc assembly of FIG. 6, such as might be used in the device of FIG. 1;

FIG. 9 is a perspective view of the disc assembly of FIG.7;

FIG. 10 is a perspective view of a vibration system in the hair remover of FIG. 1;

FIG. 11 is a side cross-sectional view taken along line 1-1 of FIG. 4 illustrating the vibration assembly with vibration element in a low position; and

FIG. 12 is a side cross-sectional view similar to Fig. 10 of the vibration assembly with the vibration element in a high position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGs. 1-12 illustrate a preferred embodiment of the hair removal device **10** according to the present invention. As shown in **FIGs. 1-12**, hair removal device **10** preferably includes a hair-plucking assembly **14** (**FIG. 1, 2**), a vibration assembly **603** (**FIG. 9**), a driving assembly **216, 202-207** (**FIG. 4, 6**), and a housing **17** (**FIG. 3**).

As shown in **FIGs. 1-2**, hair-plucking assembly **14** preferably includes, among other components described further below, a plurality of disc assemblies **500**. A preferred embodiment of disc assembly **500** is illustrated in further detail in **FIGs. 7-9**. As shown in **Fig. 7**, each disc assembly **500** preferably includes three main elements: an internal disc assembly **301** and two outer discs **212**. Each internal disc assembly **301** includes a disc carrier **302** and an insert disc **501**. Each disc carrier **302**, in turn, includes U-shaped members **305**, opposing pinchers **306**, engagement protrusions **303**, and engagement recessions **304**. Each insert disc **501** and outer disc **212** includes three radially extending arms oriented approximately 120^0 apart with each arm terminating in flattened peripheral portions **502** and **402** respectively.

U-shaped members **305** of disc carrier **302** imparts rotational motion to outer discs **212**. In addition, U-shaped members **305** serve as platforms for opposing pinchers

306, elevating opposing pinchers **306** out of the plane of radially extending arms **401** of outer disc **212** when outer disc **212** is mounted on internal disc assembly **301**, as may be appreciated in **FIG. 9**. Opposing pinchers **306** exert pressure on flattened peripheral portions **402** of adjacent disc assemblies **500** in order to form traps for hair, as described in further detail below. Engagement protrusions **303** and engagement recessions **304** connect adjacent disc assemblies **500** together, as described in further detail below.

As illustrated in **FIG. 7**, the central portion of each outer disc **212** preferably includes a generally circular opening, which is sized and shaped so that each outer disc **212** may be mounted on internal disc assembly **301**, as illustrated in **FIG. 9**. The configuration, *i.e.*, dimensions and tolerances, of components **212, 303** of each disc assembly **500** is designed such that these components fit snugly together and remain engaged during operation of the device **10** (**FIG. 1**).

When outer discs **212** are mounted on internal disc assembly **301**, flattened peripheral portions **402** of outer discs **212** are aligned with flattened peripheral portion **502** of internal disc assembly **301**, so that when flattened peripheral portions **402** are pressed against the corresponding flattened peripheral portion **502**, as illustrated in **FIG. 9**, traps that can grasp and hold hair are formed between flattened peripheral portion **502** and adjacent flattened peripheral portions **402**.

It should be noted that, in alternative embodiments, disc assembly **500** may include one or two integral pieces having between them all the elements of the three components **212, 301, 212** discussed above. In addition, it should be noted that any hair-plucking disc assembly may be used, including the disc assembly described in Dolev's patent 5,281,233. We, therefore, incorporate by reference the disc assembly described in Dolev.

As shown in **FIGs. 4-6**, in addition to a plurality of disc assemblies **500**, hair-plucking assembly **14** also preferably includes shafts **219**, bearings **210**, bearing supports **209**, and disc drive gears **220**.

Shafts **219** are preferably curved for mounting disc assemblies **500** (**FIG. 6**). Mounting disc assemblies **500** on curved shafts **219** allows disc assemblies **500** to form traps for hair, as described in further detail below. Shafts **219** may be made of any appropriate material, including various rigid or flexible materials; however, appropriate

support must be provided for curved shafts made of flexible material. Bearings **210** and bearing supports **209** transfer rotational force from disc drive gears **220** to disc assemblies **500** as well as ensure smooth rotation of disc assemblies **500**. Disc drive gears **220** impart rotational motion to disc assemblies **500** through bearings **210** and bearing supports **209**.

In the preferred embodiment illustrated in **FIGs. 4-6**, each disc assembly **500** is rotatably mounted on shafts **219**, wherein each disc assembly **500** is engaged to adjacent disc assembly or assemblies **500** via engagement protrusions **303** and recessions **304**. Specifically, each engagement protrusion **303** of one disc assembly **500** is inserted into an engagement recession **304** of an adjacent disc assembly **500** in a gear-like fashion. As a consequence of engaging disc assemblies **500**, each disc assemblies **500** is angularly offset from adjacent disc assemblies **500** by 60^0 so that flattened peripheral portions **402** of a disc assembly **500** are aligned with opposing pinchers **306** of adjacent disc assemblies **500**. Moreover, disc assemblies **500** engaged to one another are rotationally fixed with respect to one another so that they rotate in sync.

Bearings **210** and bearing supports **209** are placed between each end of each row of disc assemblies **500** and disc driving gears **220**, respectively, to transfer rotation speed from disc driving gears **220** to hair-plucking assembly **14** as well as to facilitate smooth and steady rotation of disc assemblies **500**. Disc driving gears **220** provide rotational motion to hair-plucking assembly **14**.

Preferably, the portions of disc assembly **500** intended for contact with the hair are made of a metal material such as stainless steel, which is particularly effective for plucking hair, and the portions of disc assembly **500** which contact curved shafts **219** are made of plastic such as Acetal plastic to facilitate smooth rotation of the disc assembly **500**. Alternatively, these components may be made up of other appropriate materials known in the art.

It should be noted that, although **FIGs. 2**, **4**, and **6** show that the preferred embodiment includes six disc assemblies **500** in each row of disc assemblies, in alternative embodiments, any number of disc assemblies **500** may be included in each row. In addition, it should be noted that shafts **219** need not be curved if the particular disc assemblies used do not require mounting in an inclined angle to best trap hair.

Turning now to a preferred embodiment of vibration assembly **603** depicted in **FIGs. 10-12**, vibration assembly **603** includes a vibration element **217**, vibration assembly gear **208**, and eccentric cylinder **601**. Vibration element **217** is rotatably mounted on eccentric cylinder **601**, which are, in turn, fixed to vibration assembly gear **208**. Vibration element **217** may be made of any hard and rigid material capable of withstanding all kinds of forces and scratches by vibration gear **208**. Moreover, the surface of vibration element **217**, which makes contact with the skin of the user, may be smooth or textured to provide various desired massage sensations. Mounting vibration element **217** on eccentric cylinder **601** allows vibration assembly gear **208** to impart motion to vibration element **217** as vibration assembly gears **208** rotate. This creates vibrations resulting in the massaging function of the present invention, as described in further detail below.

Turning now to a preferred embodiment of a driving assembly depicted in **FIGs. 4** and **6**, the driving assembly includes a motor **216**, a motor shaft **202**, a motor shaft gear **203**, a reduction gear **204**, a reduction gear shaft **205**, a transmission gear **206**, and a transmission gear shaft **207**. Motor **216** drives both hair-plucking assembly **14** (**FIG. 1**) as well as vibration assembly **603** (**FIG. 9**) via reduction gear system **202-207**, and can be any type of motor capable of imparting rotational motion to the reduction gear system **202-207**. Motor **216** may be operated by any convenient and available power source such as a battery or house current via a DC adaptor. Motor shaft gear **203**, reduction gear **204**, and transmission gear **206** are mounted on motor shaft **202**, reduction gear shaft **205**, and transmission gear shaft **207** respectively. Motor shaft gear **203** is engaged with reduction gear **204**, which is, in turn, engaged with transmission gear **206** to form a reduction gear system that converts the rotational speed imparted by motor **216** to a proper rotational speed to drive hair-plucking assembly **14** and vibration assembly **603**.

Turning now to a preferred embodiment of housing **17** depicted in **FIGs. 1-6**, housing **17** preferably includes two cooperating housing halves **11, 13** (**FIG. 3**), brackets **201, 213** (**FIGs. 2, 4, 6**), motor housing **218** (**FIG. 4, 6**), and power switch **15** (**FIGs. 1, 3**). Housing halves **11, 13** are ergonomically shaped to facilitate easy and comfortable gripping by one hand and is preferably constructed of plastic, although alternative materials may also be used. Brackets **201, 213** hold hair-plucking assembly **14** (**FIG. 1**) and vibration assembly **603** (**FIG. 10**) in place within housing **17**. Similarly, motor housing **218** holds motor **216** and reduction gear system **202-207** in place within housing **17** for proper operation.

In operation, when a preferred embodiment of hair-removal device **10** as illustrated in **FIG. 4** and **6** is turned on via on/off switch **15** (**FIGs. 1, 3**), motor **216** is activated and imparts rotational force to motor shaft **202**, which, in turn, imparts rotational force to motor shaft gear **203**. Motor shaft gear **203**, in turn, drives reduction gear **204** which drives transmission gear **206**. Transmission gear **206** then imparts rotational force to vibration gear **208**. Vibration gear **208**, in turn, drives disc drive gears **220**.

As disc drive gears **220** rotate, they drive bearings **210** and bearing supports **209**. Bearings **210** and bearing supports **209**, in turn, drive disc assemblies **500** (**FIGs. 7-9**). As was described above, the two rows of disc assemblies **500** are mounted on curved shafts **219** (**FIGs. 3, 5, 6**). This curvature results in disc assemblies **500** having little room between one another near the top of the hair removal device **10** so that disc assemblies **500** are actually compressed together at the top of the hair removal device **10**. This compression of disc assemblies at the top of the hair removal device **10** creates traps for hair. Specifically, when disc assemblies **500** rotate, they are compressed, or push against one another, at the top of the hair removal device **10**. As a result, opposing pinchers **306** mounted on U-shaped members **305** presses flattened peripheral portions **402** of adjacent disc assemblies **500** against their corresponding flattened peripheral portions **502**, as illustrated in **FIG. 7-9** Pressing flattened peripheral portions **402** against corresponding peripheral portions **502** forms traps for hair, as was described above and illustrated in **FIG. 9**.

While hair-plucking assembly **14** is driven by disc drive gears **220**, vibration gear **208** drives vibration assembly **603**, wherein eccentric cylinder **601** lifts and lowers the vibration element **217** rapidly, as vibration gear **208** rotates, in order to generate the massage function of the present invention. Specifically, when vibration gear **208** rotates to the position shown in **FIG. 11**, vibration beam **217** moves to a low position close to disc assemblies **500**. When vibration gear **208** rotates to the position shown in **FIG. 12**, vibration beam **217** moves to a high position away from disc assemblies **500**. Therefore, as vibration gear **208** rotates continuously, vibration beam **217** moves towards and away from disc assemblies **500** rapidly, creating vibrations that massage the hair removal area.

In an alternative embodiment that includes two rows of disc assemblies **500**, one row of disc assemblies **500** may be made to rotate in an opposite direction with respect to the other row of disc assemblies **500** such that hair is pulled away from hair removal

device **10** and skin in the hair removal area is stretched to reduce discomfort associated with hair removal.

It should be noted that the disclosed embodiments can be modified by a person skilled in the art without deviating from the scope of the present invention. For example, the orientation of hair-plucking assembly **14** in relation to housing **17** may be varied in any number of alternative configurations to optimize efficiency and convenience of use. Examples of suitable alternative configurations are described in the above-mentioned Dolev patent, incorporated herein by reference in its entirety.

While the invention has been described in conjunction with specific embodiments, it is evident that numerous alternatives, modifications, and variations will be apparent to those skilled in the art in light of the forgoing descriptions. The scope of this invention is defined only by the following claims.